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In re application of:)
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Nels Ursich)
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For: SELF-LOCKING ELECTRICAL
RECEPTACLE HAVING SAFETY PROTECTOR)

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SELF-LOCKING ELECTRICAL RECEPTACLE HAVING SAFETY PROTECTOR

BACKGROUND OF THE INVENTION

This application is a continuation of Non-provisional Application Serial No. 09/843,570 filed April 26, 2001 and claims benefit of the filing date of Provisional Application, Serial No. 60/199,926 filed April 26, 2000.

Field of the Invention

This invention relates in general to electrical receptacles for receiving male plugs and, more particularly, to a self-locking electrical receptacle having a safety protector preventing a hazardous condition resulting from the partial insertion of a male prong of a plug into the receptacle.

Summary of the Prior Art

Electrical receptacles are in universal use to provide current to an electrical cord through the connection with a male plug having male metal prongs. The prongs of the plug are normally secured in position by frictional contact with internal members of the electrical receptacle. A typical electrical receptacle is capable of conducting electricity to the prongs of the male plug even when the prongs are partially inserted into the receptacle. The exposure of male plugs externally of the receptacle when coupled to an electrical current can present significant safety hazards to any individual who comes into any direct or indirect contact with the exposed energized metal elements of the prongs.

It is also well known that a plug within a conventional electrical receptacle can easily be withdrawn intentionally or by accident to create a disconnection of the circuit to

which the receptacle is coupled. There are many circumstances under which it is desirable for reasons of convenience or safety that the connection between a plug and an electrical cord and an electrical receptacle be maintained even when significant forces are applied to disconnect the union of plug and receptacle. Several techniques have been employed in the past in an attempt to provide a more secure electrical connection between the receptacle and the plug. Most of these designs have not attained satisfactory results in use. A common problem arising from many of the prior self-locking designs is their failure to provide easy insertion and release of the lock connection. One improved design of locking the prongs of a male plug to an electrical receptacle is disclosed in U.S. Patent No. 5,413,498 to Ursich and entitled Self-Locking Female Receptor for Electrical Cords. Although the receptor of the Ursich plug provides a highly efficient locking and release technique of the plug, it is desirable to provide improved features directed to the protection against an exposed prong and provide a lock mechanism capable of optimum locking and release within the environment of an electrical receptacle.

SUMMARY OF THE INVENTION

It is, therefore, an objective of the invention to provide an improved self-locking electrical receptacle having a safety protector. The electrical receptacle herein disclosed may serve as a wall outlet and the like for receiving the plugs of electrical cords of countless types of products and appliances. The receptacle includes an externally operated actuator member for each electrical plug outlet which is moveable relative to the prongs of an inserted male plug to bias locking elements into the holes of a pair of prongs to secure the plug against withdrawal when the cord is subjected to even a substantial

force. The actuator member herein disclosed is operatively connected to locking elements which are positioned within guide means that has the capability of inserting, maintaining, or releasing locking elements relative to the conventional punched holes of the prongs of the male plug during movement of the actuator member. The actuator member may be manipulated externally of the receptacle to cause its movement within the electrical receptacle for insertion or release of the male plug. The external actuator of the actuator member is formed with an unique cross-sectional configuration to improve ease of use and to allow better insertion of male plugs having large structural configurations or other interference type problems.

The safety protection means of the invention insures that exposed prongs of a partially inserted plug in the receptacle of the invention are not connected to an electrical current. Such protection is attained in accordance with the invention because of uniquely designed terminals of the electrical receptacle herein disclosed. The terminals are provided with electrical contact means that engage the inserted plug only when the plug is fully inserted into the electrical receptacle of the invention. Thus, if the plug is only partially inserted to expose the prongs of the plug and create a potential electrical hazard, no electrical connection is provided between the terminals of the receptacle and the prongs. Thus, any hazard resulting from exposure of partially inserted prongs is substantially eliminated by the design of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front elevational view of the self-locking electrical receptacle having the safety protector of the invention;

Fig. 2 is a top plan view, with parts in section, taken along lines 2-2 of Fig. 1;

Fig. 3 is a back top perspective view, with parts broken away, of the self-locking receptacle of Fig. 1;

Fig. 4 is a side perspective view, with parts broken away, of a male plug being inserted into electrical contact with a terminal of a self-locking electrical receptacle of Fig. 1;

Fig. 4a is a bottom perspective view, with parts exploded, of the electrical receptacle of Fig. 1;

Fig. 5 is a front elevational view of one of the electrical terminals of the electrical receptacle of Fig. 1;

Fig. 6 is a top plan view of the electrical terminal of Fig. 5;

Fig. 7 is a lower rear perspective view of the electrical terminal of Fig. 5;

Fig. 8 is a lower perspective plan view of the second electrical terminal of the electrical receptacle of Fig. 1;

Fig. 8a is a front elevational view of the terminal of Fig. 8;

Fig. 9 is a lower perspective view of the locking actuator member of the self-locking receptacle of Fig. 1;

Fig. 10 is a front elevational view of the locking actuator member of Fig. 9;

Fig. 11 is a side elevational view taken along lines 11-11 of Fig. 10; and

Fig. 12 is a back elevational view of the locking actuator member of the electrical receptacle of Fig. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Figs. 1-3 and 4a, there is illustrated the self-locking electrical receptacle of the invention, generally designated by reference numeral 2. The electrical receptacle 2 includes a molded non-conductive plastic housing 4 having a cover plate 6 and hollow cavities 6' for receiving the internal components of the electrical receptacle 2. The cover plate 6 is provided with two pairs of holes 8 and 8' at each outlet to respectively receive the conventional spaced male prongs 10 of a plug (one prong is shown in Figs. 2 and 3) to create an electrical connection. Although two pairs of holes are shown in the embodiment of Fig. 1, it is within the scope of the invention to provide a single outlet formed by a pair of holes or more than two outlets in the receptacle 2 respectively formed by a pair of holes as is desired. As further seen in Fig. 2, electrical receptacle 2 includes a pair of internal actuator members 12 for locking and releasing an inserted plug (not shown). The actuator member 12 includes oval shaped, depressible actuator elements 14 that are accessible externally extending through a pair of holes 16 in cover plate 6. The actuator elements 14 are pressed to allow insertion of a male plug and pressed to release a locked plug as will be described. The oval shape of actuator element 14 not only increases the convenience and ease of depression of the actuator member 12, but also includes a greater width parallel to holes 8 and 8' than height to permit insertion of a plug having unusually large dimensions or to accommodate any unusual structural obstructions adjacent the receptacle 2.

In Fig. 4a, the components of housing 4 are best shown. The receptacle housing 4 includes face plate 6, front wall 4a, body 4b, and rear plate 4c which are interconnected

as an unit by mechanical connectors (not shown). A cover plate 7 is affixed to face plate 6, between which a rectangular shaped ground 4d is sandwiched. The cover plate 7 having central cutout 7' and ground plate 4d respectively includes a pair of holes 7a and 4d' through which actuator element 14 of the actuator member 12 extends for external access. Mechanical fasteners (not shown) may extend through holes 7b and 4d" to secure the components to the receptacle body.

As seen in Fig. 3, the electrical receptacle 2 includes a pair of separate stamped terminals 20 and 22. The terminal 20 is connected to a source of electrical potential and creates an electrical connection with one prong 10 of the male plug being inserted into hole 8. The terminal 22 is neutral and is arranged to contact the other prong of a plug being inserted within hole 8' of each outlet.

Referring to Figs. 3, and 5 to 7, details of neutral terminal 22 are best shown. The terminal 22 is formed as a one-piece stamping from a conductive material, such as copper or brass, and is formed with a flat base 24. One end portion 26 of the terminal 22 is disposed at a ninety degree angle to base 24 form a U-shaped prong contact slot 28 which is positioned to receive one end portion of a prong 10 of a plug when fully inserted through hole 8' to create a circuit in a manner to be described. The opposite end portion 30 of terminal 22 is also bent up in the same direction as end portion 26 and is formed into a second U-shaped contact slot 32 to receive the prong 10 of another plug being inserted in electrical receptacle 2 into hole 8'. Contact slot 28 includes a pair of spaced flat contact elements 28a, 28b and 28c to form a rectangular prong receiving opening 28d. Further as seen in Figs. 1 to 4 and 8 contact slot 32 includes a pair of spaced flat

contact elements 32a and 32b and connecting portion 32c to form prong receiving opening 32d.

The lengths of the contact elements 28a, 28b and 32a, 32b and the distances of prong receiving openings 28d, 32d from the external portion of holes 8' are selected to receive and make contact with a prong 10 when only the prong is fully inserted in holes 8' and further permit the punched hole 10a of a prong 10 be exposed for locking (Fig. 4). Thus, the only inserted position at which prong 10 can be in electrical contact with slots 28 and 32 of terminal 22 is by being substantially fully inserted into holes 8'. An electrical connection is prevented between the prongs and the respective contact element when a prong 10 is partially inserted and externally exposing the prong. The end portion 30 (Fig. 7) extends upward and bent over to form a two layer flat lead connector 34 having a hole 36 to allow a threaded member (not shown) to be inserted and attach an electrical lead (not shown) to the terminal 22 which is to ground. Strengthening sections 38a and 38b of end portions 26 and 30 are respectively bent over slots 28 and 32 to increase the structural strength of the contact slots. The spacing between contact elements 28a and 28b and between contact elements 32a and 32b is selected to insure contact with the inserted plug and make an electrical connection therebetween.

Referring to Figs. 8 and 8a, details of the energized electrical conductive terminal 20 is best illustrated. As seen in Fig. 3, the terminal 20 includes a modified shape as compared to terminal 22 to allow it to be disposed within the housing 4 in spaced adjacent relationship to terminal 22 within housing 4. The terminal 20 has a base 40 having a cutout section 40a. A bent end portion 42 of terminal 20 includes two right-angled sections 42a, 44. End portion 44 is bent back to form a U-shaped contact slot 46

for contact with a male prong 10. The contact slot 46 includes spaced contact elements 46a and 46b and connecting portion 46c to form prong receiving opening 46d. A strengthening element 48 is bent back into contact with contact slot 46 for increasing the strength of the contact.

The other end portion 50 of terminal 20 includes a section 50a offset in parallel relation to base 40 and a right angled section 50b having a U-shaped projection extending therefrom to form a second contact slot 52 to receive another prong 14 of the plug being inserted into the electrical receptacle 2. The contact slot 52 includes spaced contact elements 52a and 52b and connecting portion 52c to form prong receiving opening 52d. A bent over section 53 increases the strength of contact 52. The right angled section 42 has an upward extension 54 that is bent at a right angle to form a bent back connector 56 having a hole 58 to allow a wire connected to an electrical current to be attached by a threaded element (not shown) and the like. As seen in Fig. 3, the contact slot 46 of terminal 20 is disposed in opposed operative relationship to the contact slot 28 of terminal 22 to receive a pair of prongs10 of a plug being inserted into holes 8, 8' of the receptacle 2. The contact slot 52 is disposed adjacent to contact slot 30 of terminal 22 to receive the prongs 10 of another inserted plug to connect the circuit to a source of electrical current and to neutral. Inasmuch as contact slots 46 and 52 of terminal 20 are of a substantially identical construction as contact slots 28 and 30 of terminal 22 and are positioned at an identical depth within housing 4, each prong 10 creates electrical contact with a contact slot when its end portion is inserted with each punched hole 10a is exposed as seen in Fig. 4. To aid in exposure of the punched hole, a curved cutout 100 (Fig. 4) may be provided on the end of each open ended contact slot of terminals 20 and

22. Accordingly, a prong 10 must be fully inserted into the electrical receptacle into slots 28, 46 or slots 30, 52 before contact with the terminals 20 and 22 is made for an electrical connection. Thus, prior to full insertion, any exposed portions of the prongs 10 are not connected to the terminals 20 and 22 and do not create a potential hazard because the prongs are not fully inserted.

Referring now to Figs. 1, 2, 3, 4a and 9 to 12, details of actuator member 12 for locking and releasing an inserted plug 10 are best illustrated. Actuator member 12 may be formed as a single-piece, non-conductive plastic material and the like. The upper portion 70 of actuator member 12 projects through an opening 72 formed in the upper portion 72a of electrical receptacle 2 and the cover plate holes 16, and forms external actuator 14, which may be manually depressed. The cross-sectional configuration of upper portion 70 is generally oval as previously described. An open cavity 74 is formed in the rear of upper portion 70 and receives a resilient spring 74a disposed between wall 74' and element 74" of the cavity 74 and a portion (not shown) of housing 4 to bias the actuator member 12 outward relative to electrical receptacle 2 when the actuator 14 is released.

The base 76 of actuator member 12 is formed as a block having generally flat side opposed faces 78a, 78b and flat bottom face 80. The base 76 is interconnected to upper portion 70 by a narrowed intermediate section 82. The opposed faces 78a each have a locking slot 84 creating a guide means for a locking element 88 in the form of a plastic ball and the like (Fig. 2 and 11). The slot 84 has a varying depth with slot section 84a having a shallower depth than lower slot section 84b (Fig. 11). The slot sections 84a and 84b are interconnected by a connecting ramp 84c. The actuator element 88 in the form of

a plastic ball and the like is situated within the opposed locking slots 84 of both actuator members 12 of a size to engage prong hole 10a. As seen in Fig. 2, bottom face 80 is slideable along wall 90 of housing 4 while face 78c contacts for a sliding motion walls 92 of housing 4. The bottom face 80c of actuator member 12 also is slideable along a surface (not shown) of housing 4. Accordingly, it should be apparent that depression of actuator element 14' causes the actuator member 14 to move along an axis generally perpendicular to the place of faceplate 6.

As seen in Figs. 2, 9 and 11, each of the opposed slots 84 having a longitudinal axis extending parallel along the axis of movement of the actuator member 12. As a result, the locking element 88 is positioned in shallow slot section 84a while the actuator member 12 is in its normal, outwardly biased position. As the actuator 14 is depressed to cause movement of the actuator member 14 within the receptacle 2, the locking element 88 is positioned within the deeper slot section 84b. While in the deeper slot section 84b, the locking element moves away from the prong 10 or prong hole 10a to allow the insertion of the prong of a plug or release of a locking element 88 positioned in prong hole 10a during depression of the actuator member 14. Upon release of the actuator member 12 after a prong 10 is fully inserted, the locking element 88 is positioned in the shallow section 84a by which the wall 84' of slot 84 (Figs. 2, 9 and 11) biases the locking element 88 into the exposed, adjacent hole 10a of an inserted prong. A pair of actuator members 14 are employed in connection with the pair of holes 8 and 8' of each outlet of the two outlet electrical receptacle 2. Thus, additional actuator members 14 and locking elements 88 may be used when the electrical receptacle 2 includes more than two electrical outlets as shown. As seen in Fig. 2, each actuator member is moveable between

the spaced prongs 10 of a male plug to respectively insert locking elements 88 into holes 10a of the prongs 10 being inserted into contact slots 28 and 46 or slots 30 and 52 of the terminals 20 and 22. The design of the electrical receptacle 2 insures that the prong 10 of a two prong plug is in both a position for locking and in a respective contact slot when substantially fully inserted into electrical receptacle 2.